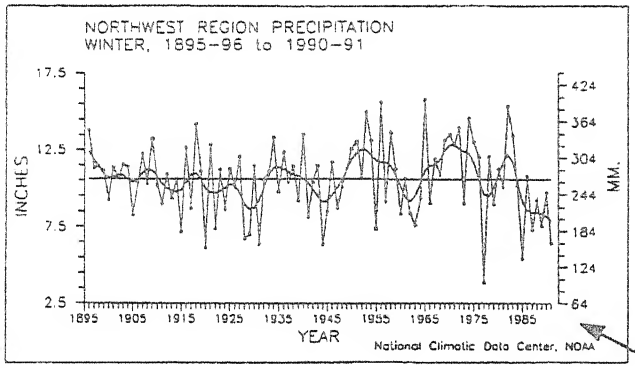
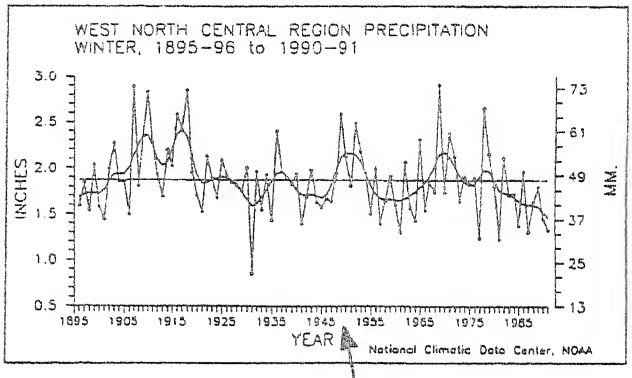
CLIMATE ANALYSIS CENTER

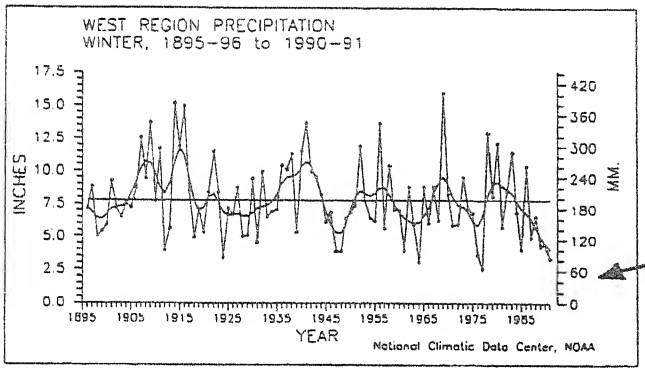
CONTAINS:
WINTER 1990–91
UNITED
STATES
CLIMATE
SUMMARY

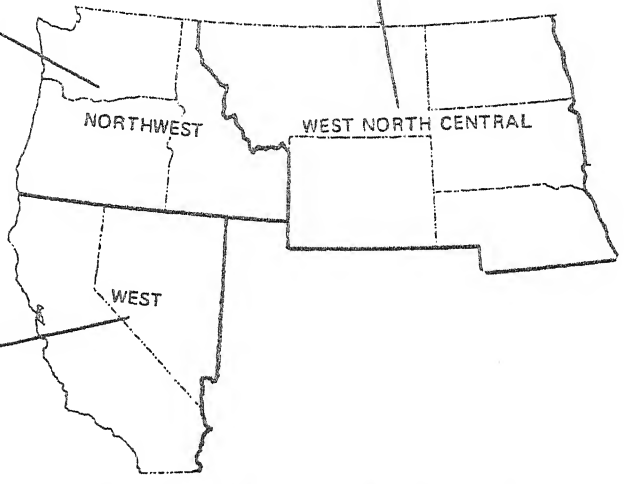
WEEKLY CLIMATE BULLETIN

No. 91/11 Washington, DC March 16, 1991









During this Winter (December 1990 – February 1991), near–record dryness not only afflicted most of California and the West region [3rd driest], but also covered the Northwest and West–North Central regions, ranking as the sixth driest Winter in both areas since 1895. On a state–wide basis, exceptionally dry conditions were found in Wyoming [3rd], Oregon [3rd], Nevada [4th], Idaho [4th], California [5th], and Montana [9th]. Farther east, even portions of the central Plains recorded under half the normal Winter precipitation; however, a majority of the normal annual precipitation typically falls during the spring and early summer months (April – June) in this region.

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE–NATIONAL METEOROLOGICAL CENTER
CLIMATE ANALYSIS CENTER

WEEKLY CLIMATE BULLETIN

This Bulletin is issued weekly by the Climate Analysis Center and is designed to indicate, in a brief concise format, current surface climatic conditions in the United States and around the world. The Bulletin contains:

- *Highlights of major climatic events and anomalies.*
- *U.S. climatic conditions for the previous week.*
- *U.S. apparent temperatures (summer) or wind chill (winter).*
- *U.S. cooling degree days (summer) or heating degree days (winter).*
- *Global two–week temperature anomalies.*
- *Global four–week precipitation anomalies.*
- *Global monthly temperature and precipitation anomalies.*
- *Global three–month precipitation anomalies (once a month).*
- *Global twelve–month precipitation anomalies (every three months).*
- *Global three–month temperature anomalies for winter and summer seasons.*
- *Special climate summaries, explanations, etc. (as appropriate).*

Most analyses contained in this Bulletin are based on preliminary, unchecked data received at the Climate Analysis Center via the Global Telecommunications System. Similar analyses based on final, checked data are likely to differ to some extent from those presented here.

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GLOBAL CLIMATE HIGHLIGHTS

MAJOR CLIMATIC EVENTS AND ANOMALIES AS OF MARCH 16, 1991

1. Southeastern North America:

LIGHT PRECIPITATION IN MOST AREAS.

A relatively dry week affected most of the region, except for near normal precipitation from Missouri eastward through the southern Ohio Valley, along the central Gulf and south Atlantic coasts, and across the Canadian Maritimes. In addition, abnormally heavy totals were measured in east-central Texas and from central Iowa eastward through eastern Indiana. Much of the precipitation across the Midwest fell as snow or freezing rain, creating severe travel problems and downing numerous trees and power lines, particularly in Indiana. Fortunately, continued light precipitation across most of the area has restricted significant surpluses to portions of the Gulf Coast, Deep South, and Canadian Maritimes, where roughly two to four times the normal totals have been measured since mid-February [Ending after 16 weeks].

2. Central Europe:

WARM AND DRY CONDITIONS PERSIST.

Little or no precipitation was measured across most of Europe from France eastward through eastern Europe. Only portions of southern Ireland, southern Scotland, coastal Normandy, the Iberian Peninsula, Scandinavia, southern Italy, and Greece measured more than 20 mm. Since early February, departures of 50–100 mm have accumulated, with deficits approaching 220 mm in the highest elevations across Italy, Romania, Austria, and Germany. Only 20%–50% of normal precipitation has fallen across France during the period [13 weeks]. Abnormally mild air overspread much of Europe, with most locations from the northern Iberian Peninsula, Italy, and Balkans northward through the British Isles and central Scandinavia averaging 3°C to 6°C above normal. Weekly departures reached +9°C across Germany, the Benelux countries, Poland, and southern Scandinavia, where daily temperature departures exceeded +10°C in spots [3 weeks].

3. West–Central Sahel

EXTENT OF ABNORMAL WARMTH REMAINS LIMITED.

Temperatures averaging 1°C to 3°C above normal were restricted to southern Mali, Burkina Faso, southern Niger, and parts of Senegal, keeping anomalous departures confined to those locations [7 weeks].

4. Southeastern Africa:

HOT WEATHER DIMINISHES SLIGHTLY.

Temperatures averaged 1°C to 3°C above normal across Zimbabwe, Botswana, Zambia, and northern Namibia while cooler than normal conditions spread through eastern South Africa [Ending after 3 weeks].

5. The Philippines:

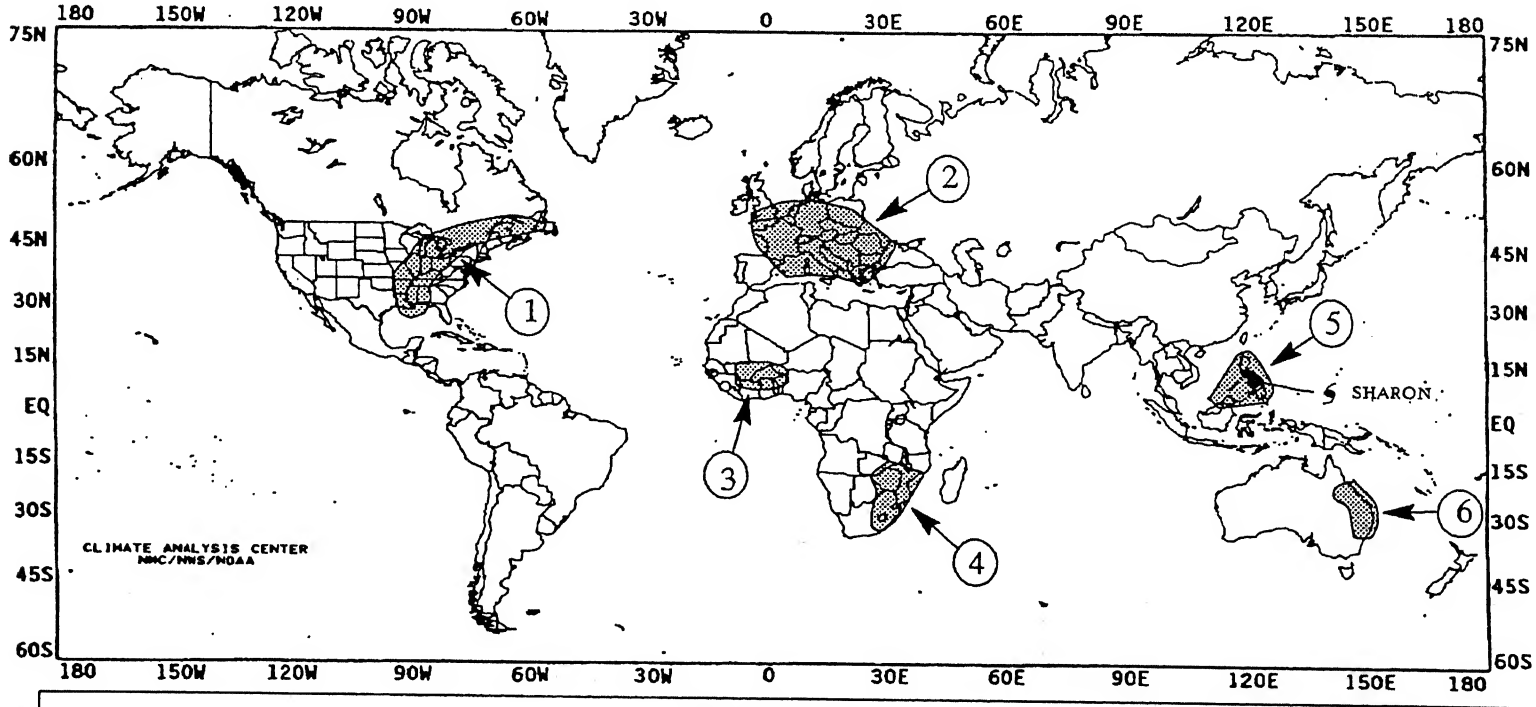
TYPHOON SHARON DELUGES CENTRAL ISLANDS.

Little or no rain again fell across most of Luzon and Mindanao, but minimal Typhoon Sharon brought heavy rains from southern Luzon southward to extreme northern Mindanao. Most locations measured 50–150 mm, with isolated totals approaching 325 mm near landfall in southern Samar, where daily amounts reached 205 mm. Despite the relief provided by Sharon, large deficits remained throughout the islands. Since early February, nearly 200 mm below normal amounts have been recorded in portions of Luzon [Ending after 15 weeks].

6. Eastern Australia:

MOISTURE DEFICITS DEVELOP.

After several periods of inundating rainfall farther north, a dry spell has generated significant precipitation shortfalls from southeastern Queensland southward through the eastern halves of New South Wales and Victoria. Weekly totals of only 15–30 mm have been measured along the coast while most inland locations have recorded amounts below 10 mm. Since early February, deficits of 50–165 mm have accumulated across the region, with isolated locations in east-central Victoria and New South Wales measuring less than 10% of normal rainfall [5 weeks].



EXPLANATION

TEXT: Approximate duration of anomalies is in brackets. Precipitation and temperature data are this week's values, unless otherwise indicated.

MAP: Approximate locations of major anomalies and episodic events are shown. See other maps in this Bulletin for current two-week temperature anomalies, four-week precipitation anomalies, longer-term anomalies, and other details.

UNITED STATES WEEKLY CLIMATE HIGHLIGHTS

FOR THE WEEK OF MARCH 10 THROUGH MARCH 16, 1991

Wintry conditions dominated much of the eastern and western U.S. hile spring-like weather abounded across portions of the nation's idsection. An intense,late winter storm system paralyzed parts of the lidwest with heavy snow, freezing rain, and wind gusts to 50 mph which hipped snow drifts up to 10 feet high in northern Illinois and Indiana. he snow and ice left motorists stranded in portions of Indiana, Illinois nd Minnesota after the closure of dozens of roads, including a 120-mile ection of I-90 between Albert Lea and Worthington, MN. Heavy eezing rain coated some areas with up to 4 inches of ice, downing umerous trees and power lines and knocking-out power to 250,000 ustomers in Indiana and Illinois. Officials at PSI Energy of Indiana aced damage estimates to electrical utilities at $10 million. Farther outh, unseasonably cold weather settled across the Southeast as lows ipped below freezing as far south as northern Florida, producing umerous daily record lows across southern Florida. Farther west, nother in a recent series of March Pacific storm systems brought up to a ot of snow to portions of the Sierra Nevadas while rain fell on lower evations from central California to western Washington. Upwards to 7.6 ches of precipitation fell on parts of northern and central California, ontinuing to provide short-term drought relief and delay the nplementation of stricter water rationing guidelines. This month's enerous precipitation has raised water storage levels in reservoirs by as uch as 13% in some areas over the last two weeks. Authorities in Marin ounty reported that reservoirs were now at 44% of capacity as of March 2. up from 31% two weeks earlier. Meanwhile, dry and unseasonably arm conditions enveloped much of the central U.S. as highs were up to 0°F above normal at a few locations on Monday and Tuesday [Figure 1]. ery strong northwesterly winds from an explosively developing low ressure center over Kansas kicked up top soil and created a dust storm ross portions of the central High Plains. In Alaska, heavy snow and high inds produced blizzard conditions and wind chills to -70°F across ortions of the Seward Peninsula, influencing the outcome of the annual ditarod dog sled race. To the east, as much as two feet of snow blanketed aldez Saturday. In contrast, heavy rain and high winds battered parts of he big island of Hawaii. Some flooding was reported after 8.25 inches of ain fell in 24 hours at Mountain View, and Hilo measured over 14 inches uring the week.

The week began with a weak low pressure system over the central ppalachians, a developing storm in the central Rockies,and another orm system pushing into the Far West. The system in the East dumped p to 6 inches of snow on parts of West Virginia and western Maryland efore dissipating. Brisk north winds funnelled unseasonably cold air own the lee-side of the Appalachians, producing near-zero wind chills ross parts of the mid-Atlantic Monday morning. Meanwhile, lows ipped into the thirties across most of northern and central Florida, stablishing or tying numerous daily minimum temperature records from ey West to Tallahassee. In sharp contrast, much of the Great Plains asked in unseasonable warmth as highs soared above 70°F as far north as outh Dakota. To the west, a major storm system developed in the central ockies and tracked eastward, rapidly deepening over the nation's idsection. Heavy snow covered parts of the central Plains while violent understorms erupted over the lower Missouri Valley as the system ontinued its eastward progression. One thunderstorm spawned a tornado hich touched down near Glasgow, MO while another produced hail and 60 mph winds at Columbia, MO. Farther west, the next in a series of storms to affect the West Coast pushed into northern California, dumping heavy rain across the lower elevations of northern and central California and up to a foot of snow in the mountainous areas.

During the last half of the week, the storm in the nations midsection slowly advanced eastward, spreading as much as a foot of snow from southern Minnesota southeastward into northern Indiana. In areas just to the south, freezing rain and sleet glazed portions of Indiana and Illinois, creating hazardous driving conditions and disrupting electrical service. The storm later tracked to the mid-Atlantic and merged with a secondary area of low pressure off the Carolina coast. A mixture of precipitation fell across portions of the mid-Atlantic while up to a foot of snow blanketed southern New England as the storm tracked up the New England coast. Farther west, another storm pushed southeastward across northern California on Friday, spreading rain from the northern sections of the state to the southern desert areas while dumping a foot of snow on the central and southern mountains. Unseasonably cold air spilled into the Far West behind the storm system, with numerous new daily record lows from Washington to southern California.

According to the River Forecast Centers, the greatest weekly totals (more than 2 inches) occurred across the northern half of California into parts of western Oregon, along the western Gulf Coast, in portions of the central and western Corn Belt, along the southern coast of Alaska, and in eastern Hawaii [Table 1]. Light to moderate amounts fell on much of country west of the Rockies, the central Rockies, throughout much of the eastern half of the nation, and the remainder of Hawaii and Alaska. Little or no precipitation was recorded in the parts of the desert Southwest, northern Intermountain West, across most of the northern and southern thirds of the Rockies, northern Great Plains and Great Lakes, and south-central Mississippi Valley.

Unseasonably warm weather continued across much of the northern Plains and Rockies for the second consecutive week as early week highs reached levels more representative of mid-spring than late winter. Despite the warm conditions, few daily record highs were established, but weekly departures of +6°F to +13°F were common from Montana to Wisconsin [Table 2]. Temperatures averaging 3°F and 6°F above normal were widespread from southwestern Texas northeastward into the western Great Lakes, and across Maine. Mild conditions were also evident across portions of southwestern Alaska where weekly departures of +7°F were recorded at Cold Bay and Bethel.

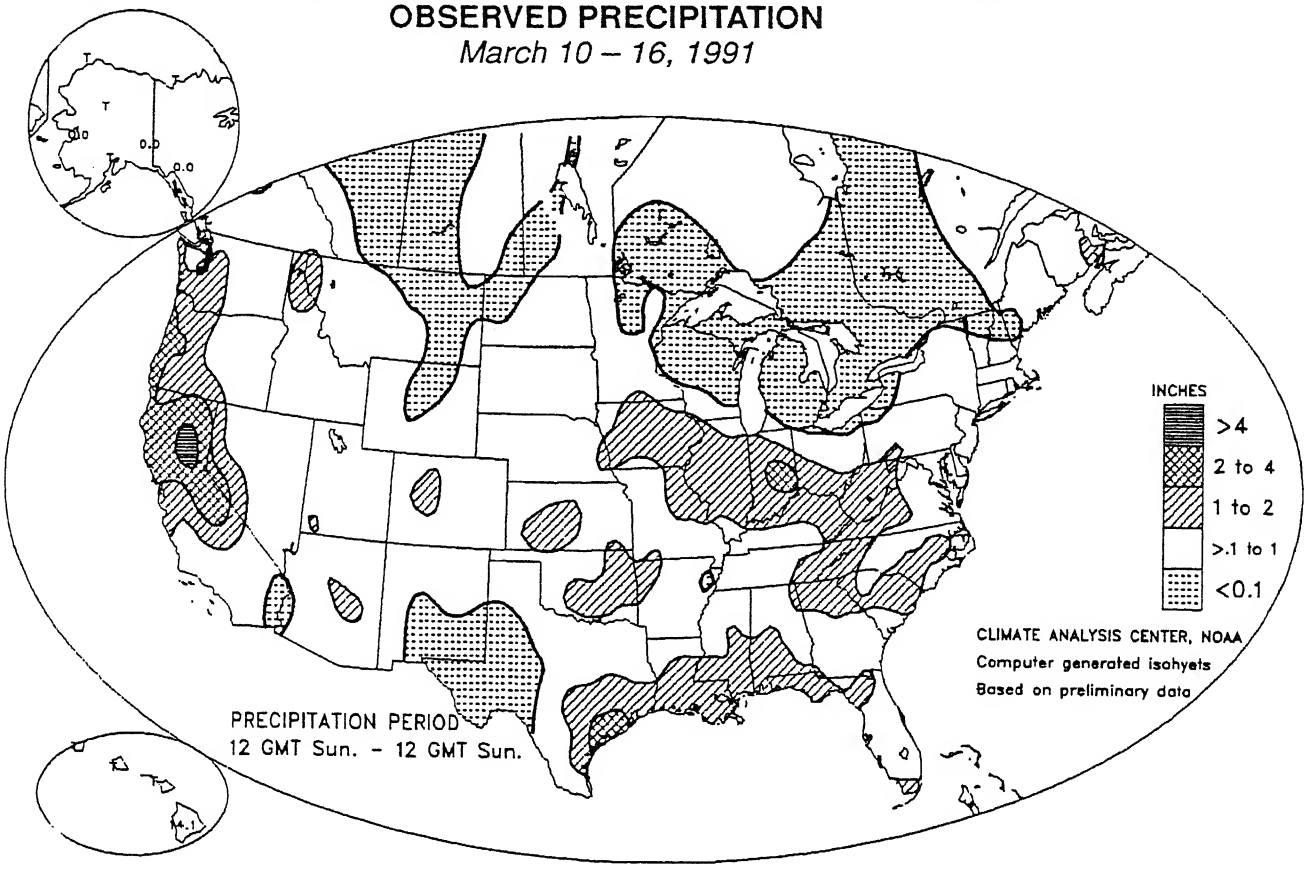
In sharp contrast, unseasonably cold conditions were recorded across most of the eastern and western U.S. [Table 3]. Weekly departures between -3°F and -7°F were common across much of the mid-Atlantic and southern New England as highs hovered in the thirties during mid-week. An invasion of cold air early in the week across the Deep South was significant enough to produce weekly departures between -4°F and -7°F across much of Florida and along portions of the central Gulf Coast. Farther west, cold weather produced several daily record lows from Washington to southern California. Weekly departures between -5°F and -9°F were observed across much of California, with lows dipping to near freezing as far south as central California. In Alaska, subnormal temperatures returned to most of the state after two straight weeks of exceptional mildness as weekly departures exceeded -4°F in the interior and northern areas.

TABLE 1. Selected stations with 1.75 or more inches of precipitation for the week.

STATION	TOTAL (INCHES)	STATION	TOTAL (INCHES)
HILO/LYMAN, HAWAII, HI	14.23	KINGSVILLE NAS, TX	2.11
YAKUTAT, AK	4.46	CORDOVA/MILE 13, AK	2.02
MARYSVILLE/BEALE AFB, CA	2.94	EUREKA, CA	1.94
VICTORIA, TX	2.82	REDDING, CA	1.91
RED BLUFF, CA	2.69	ADAK, AK	1.90
NORTH BEND, OR	2.64	ASTORIA, OR	1.89
DILLINGHAM, AK	2.45	CHICAGO/O'HARE, IL	1.87
MOLINE, IL	2.41	ILIAMNA, AK	1.86
INDIANAPOLIS, IN	2.29	BEEVILLE NAS, TX	1.83
PALACIOS, TX	2.20	CORPUS CHRISTI NAS, TX	1.83

OBSERVED PRECIPITATION

March 10 – 16, 1991



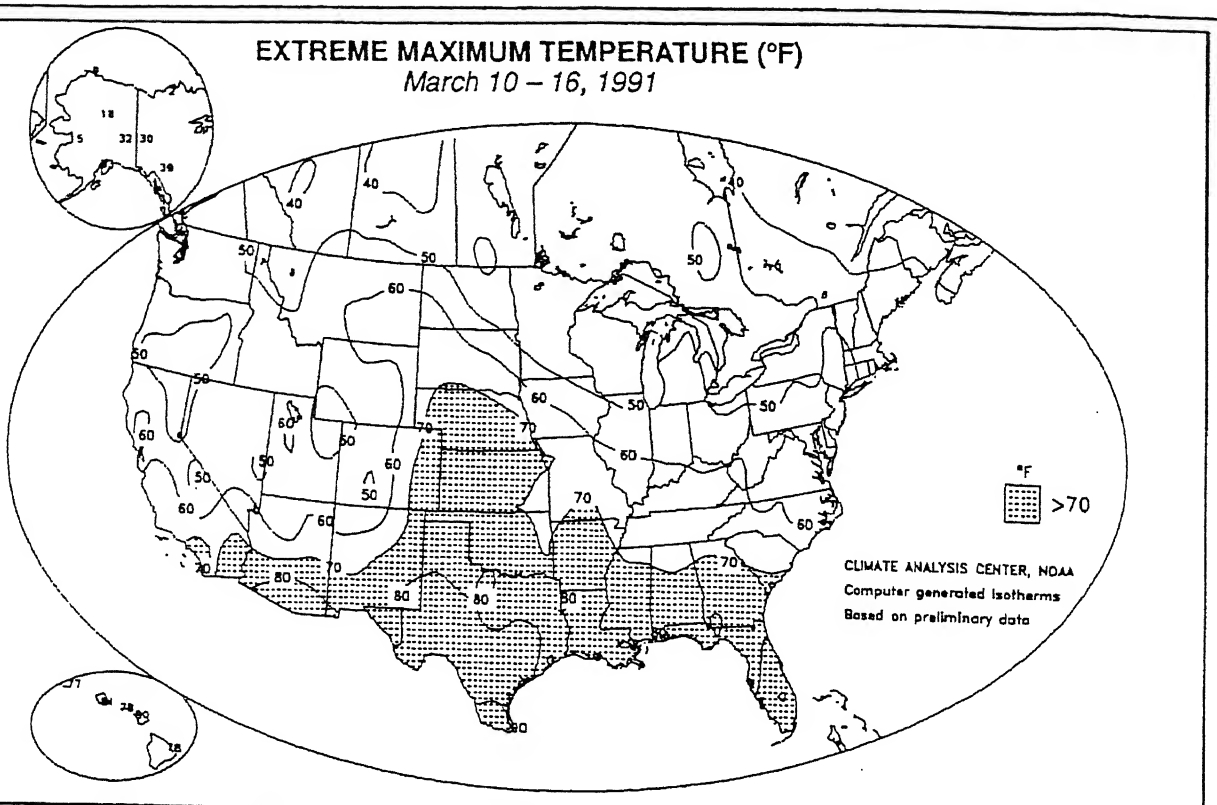


Figure 1. Extreme maximum temperatures (°F) during the week of March 10-16, 1991. Although there were few daily record highs during the week across the lower 48 states, weekly temperature departures still exceeded +6°F in the northern Plains and upper Midwest due to a lack of any Arctic air intrusions. Elsewhere, cooler conditions in the eastern and western thirds of the country kept extreme maximum temperatures relatively low for this time of year. It was only a year ago that several days of record-breaking readings in the eighties (and nineties at a few locations) occurred across much of the Southeast and mid-Atlantic, promoting record early blooming of flowers, shrubs, and trees in northern areas.

TABLE 2. Selected stations with temperatures averaging 6.0°F or more ABOVE normal for the week.

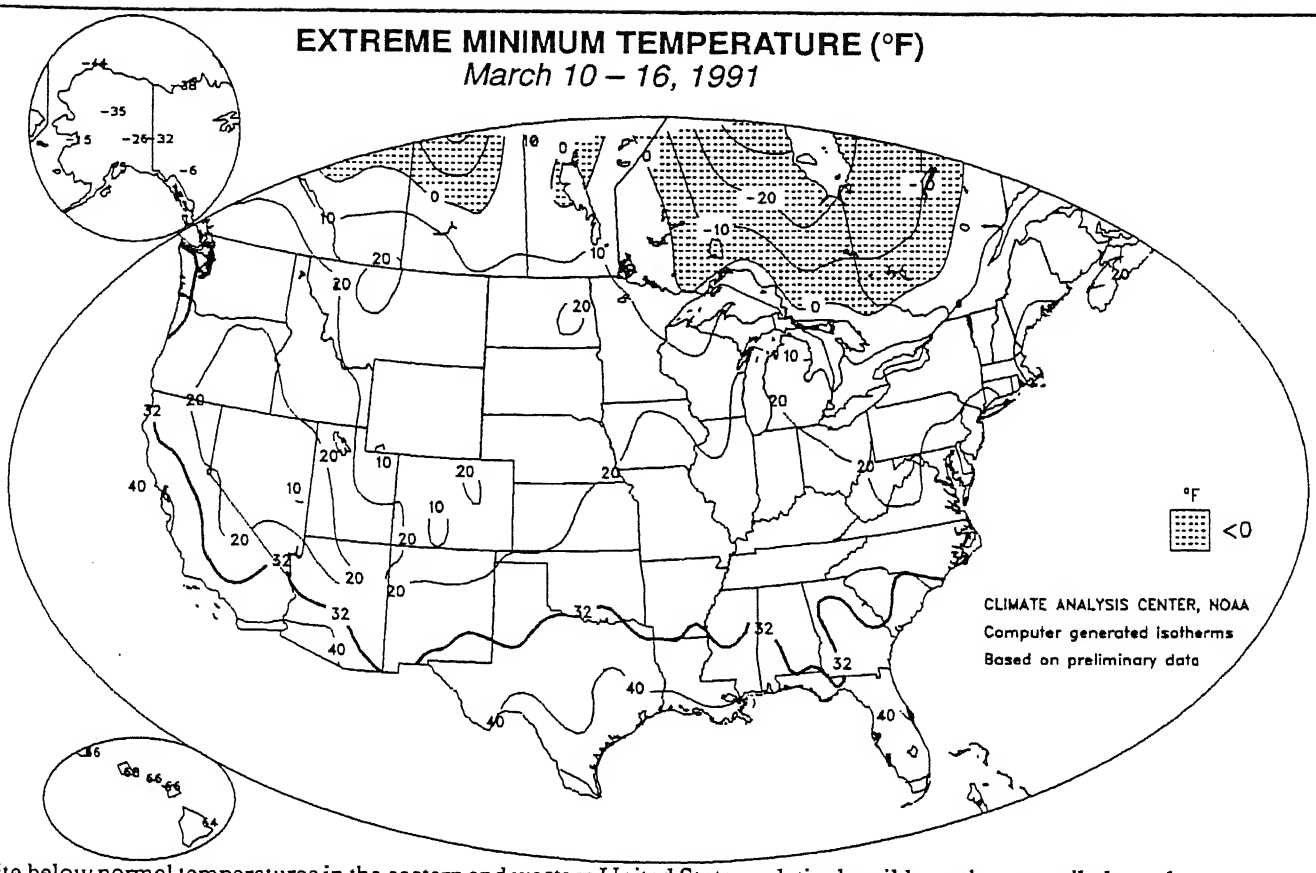
ATION	DEPARTURE (°F)	AVERAGE (°F)	STATION	DEPARTURE (°F)	AVERAGE (°F)
LLISTON, ND	+12.7	36.9	LEWISTOWN, MT	+7.6	34.7
AND FORKS, ND	+11.6	31.8	GREAT FALLS, MT	+7.5	38.1
IOT, ND	+11.2	33.8	COLD BAY, AK	+7.0	35.4
VIL'S LAKE, ND	+11.2	31.3	MINNEAPOLIS, MN	+7.0	34.5
ASGOW, MT	+11.1	37.3	ABERDEEN, SD	+6.9	32.7
KINSON, ND	+11.1	36.3	RAPID CITY, SD	+6.8	38.2
RGO, ND	+10.6	33.1	WATERTOWN, SD	+6.8	31.5
ES CITY, MT	+9.8	39.8	BILLINGS, MT	+6.7	39.5
MARCK, ND	+9.8	34.4	EAU CLAIRE, WI	+6.7	32.7
IESTOWN, ND	+9.6	32.1	SHERIDAN, WY	+6.5	37.4
RE, MT	+9.4	37.4	HELENA, MT	+6.5	37.3
XANDRIA, MN	+9.3	31.9	BETHEL, AK	+6.5	16.5
ERNATIONAL FALLS, MN	+8.7	27.6	LANDER, WY	+6.1	37.2
CLOUD, MN	+8.4	32.8	WORLAND, WY	+6.0	38.1
BANK, MT	+7.9	34.1			

TABLE 3. Selected stations with temperatures averaging 6.0°F or more BELOW normal for the week.

TION	DEPARTURE (°F)	AVERAGE (°F)	STATION	DEPARTURE (°F)	AVERAGE (°F)
ZEBUE, AK	-12.8	-14.2	GAINESVILLE, FL	-7.0	56.9
TLES, AK	-10.1	-8.8	GOLDSBORO/JOHNSON AFB, NC	-6.8	44.9
DING, CA	-9.4	44.4	HAMPTON/LANGLEY AFB, VA	-6.7	40.7
E CANYON, CA	-8.8	28.9	DAGGETT, CA	-6.7	50.3
H, CA	-7.7	43.7	MOUNT SHASTA, CA	-6.6	33.1
ROW, AK	-7.5	-24.5	FAYETTEVILLE, NC	-6.6	45.7
NS, WV	-7.4	31.3	SEXTON SUMMIT, OR	-6.4	30.9
BLUFF, CA	-7.2	45.6	DANVILLE, VA	-6.3	41.9
EETNA, AK	-7.1	11.2	SAN BERNARDINO/NORTON AFB,CA	-6.3	49.6
GANTOWN, WV	-7.1	33.2	NEW BERN, NC	-6.2	45.5
ERSFIELD, CA	-7.1	49.4	NORTHWAY, AK	-6.1	-1.6
YSVILLE/YUBA CO, CA	-7.0	47.1			

EXTREME MINIMUM TEMPERATURE (°F)

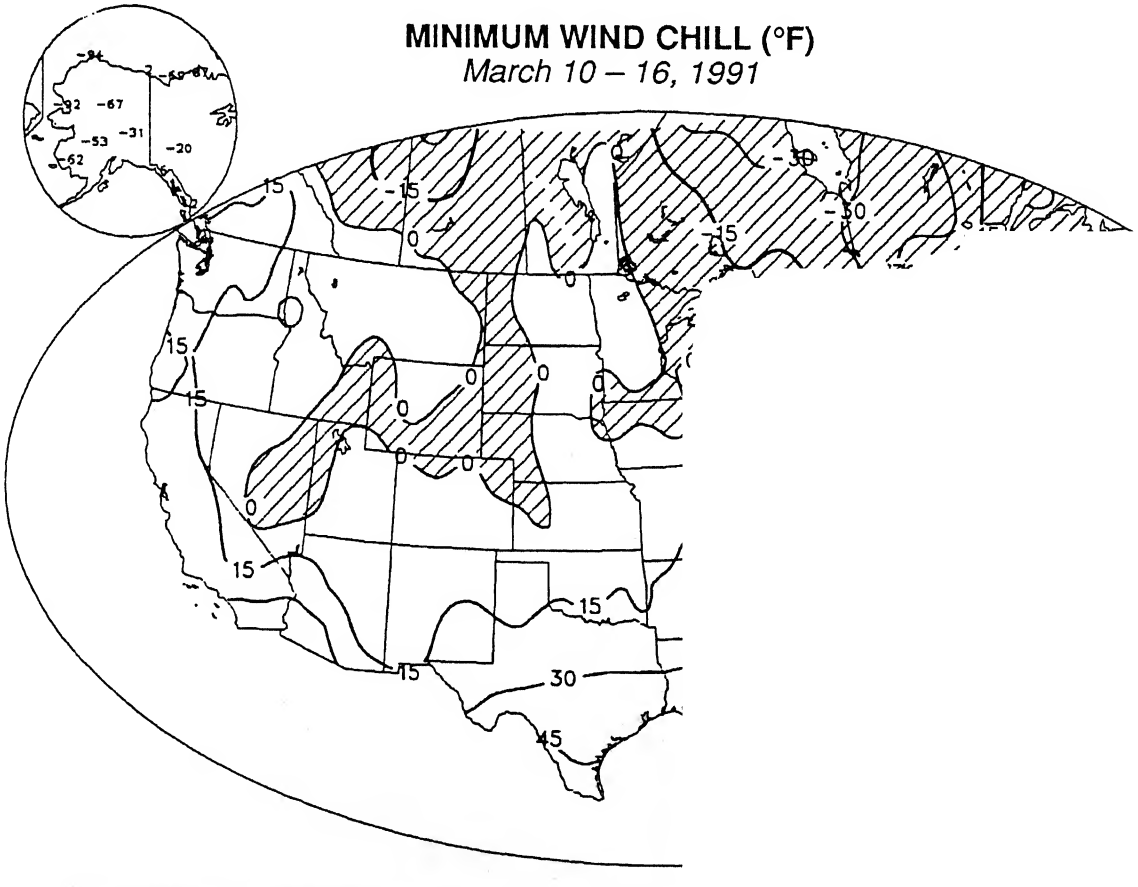
March 10 – 16, 1991



Despite below normal temperatures in the eastern and western United States, relatively mild weather prevailed as subzero temperatures retreated northward into Canada (top). Bitterly cold wind chills (<0°F), however, accompanied cold air outbreaks in the Great Basin, central Rockies, and portions of the Plains, Midwest, and Northeast (bottom).

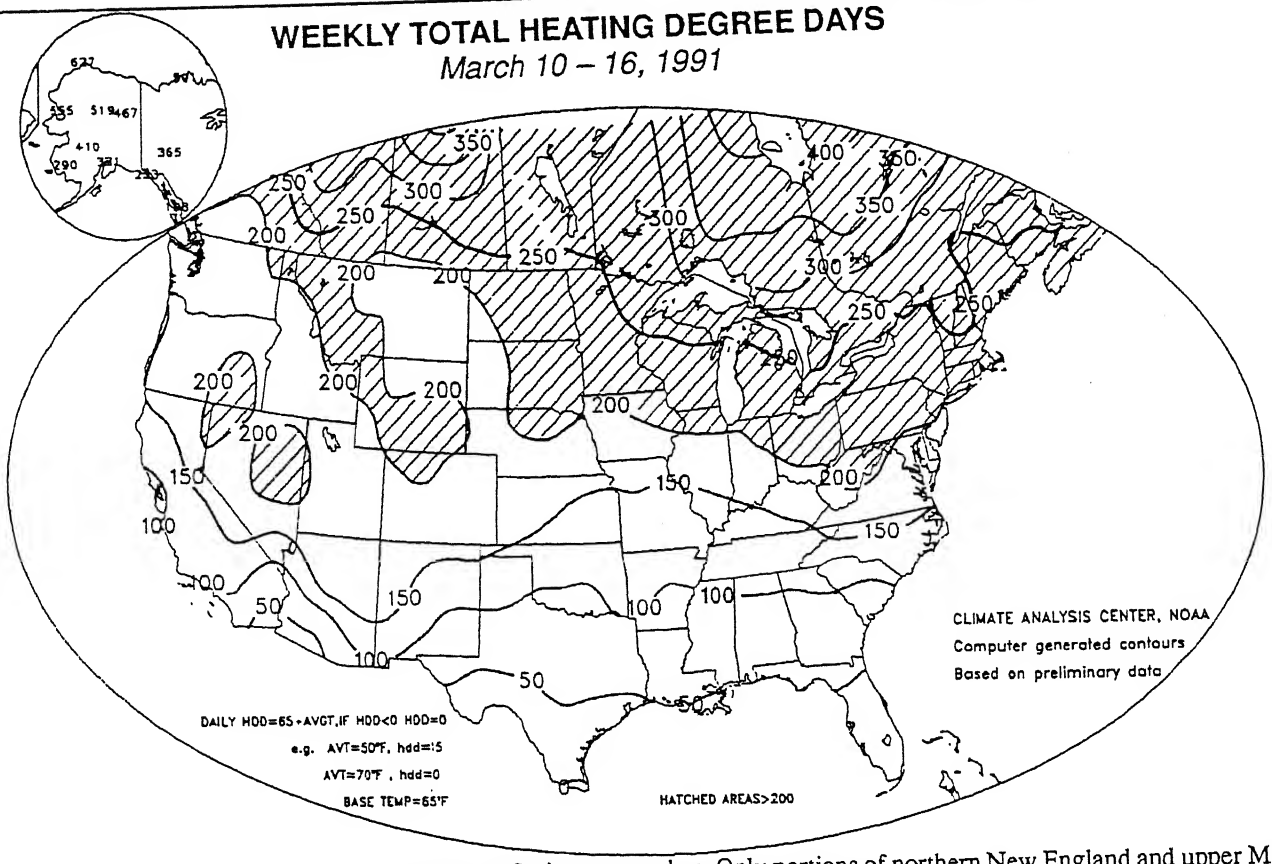
MINIMUM WIND CHILL (°F)

March 10 – 16, 1991



WEEKLY TOTAL HEATING DEGREE DAYS

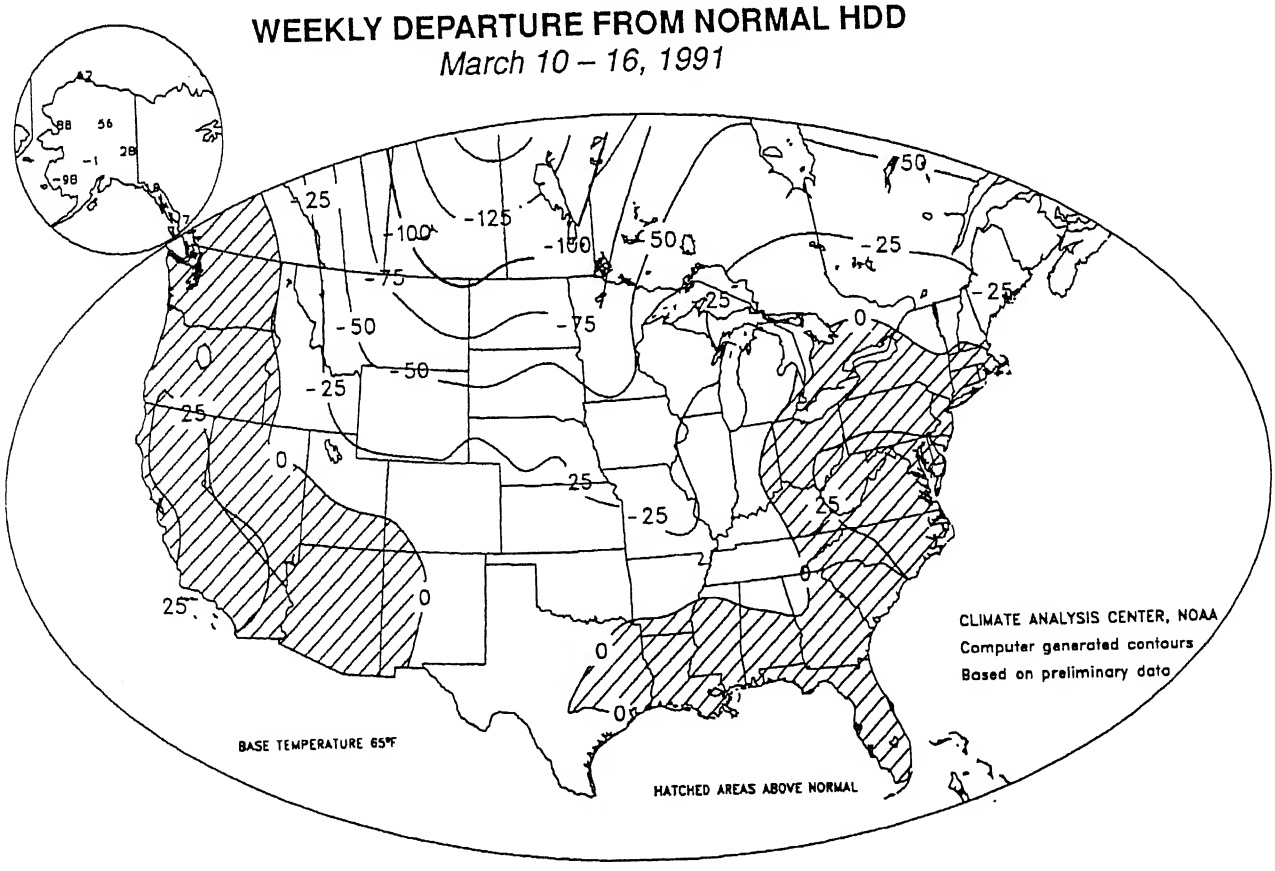
March 10 – 16, 1991



Nationwide, heating demand continued to decline as Spring approaches. Only portions of northern New England and upper Midwest generated substantial heating usage (>250 HDD's; top). Relative to the time of year, however, much of the East and West Coast States, Deep South, and the southern Intermountain West experienced slightly above normal heating demand (bottom).

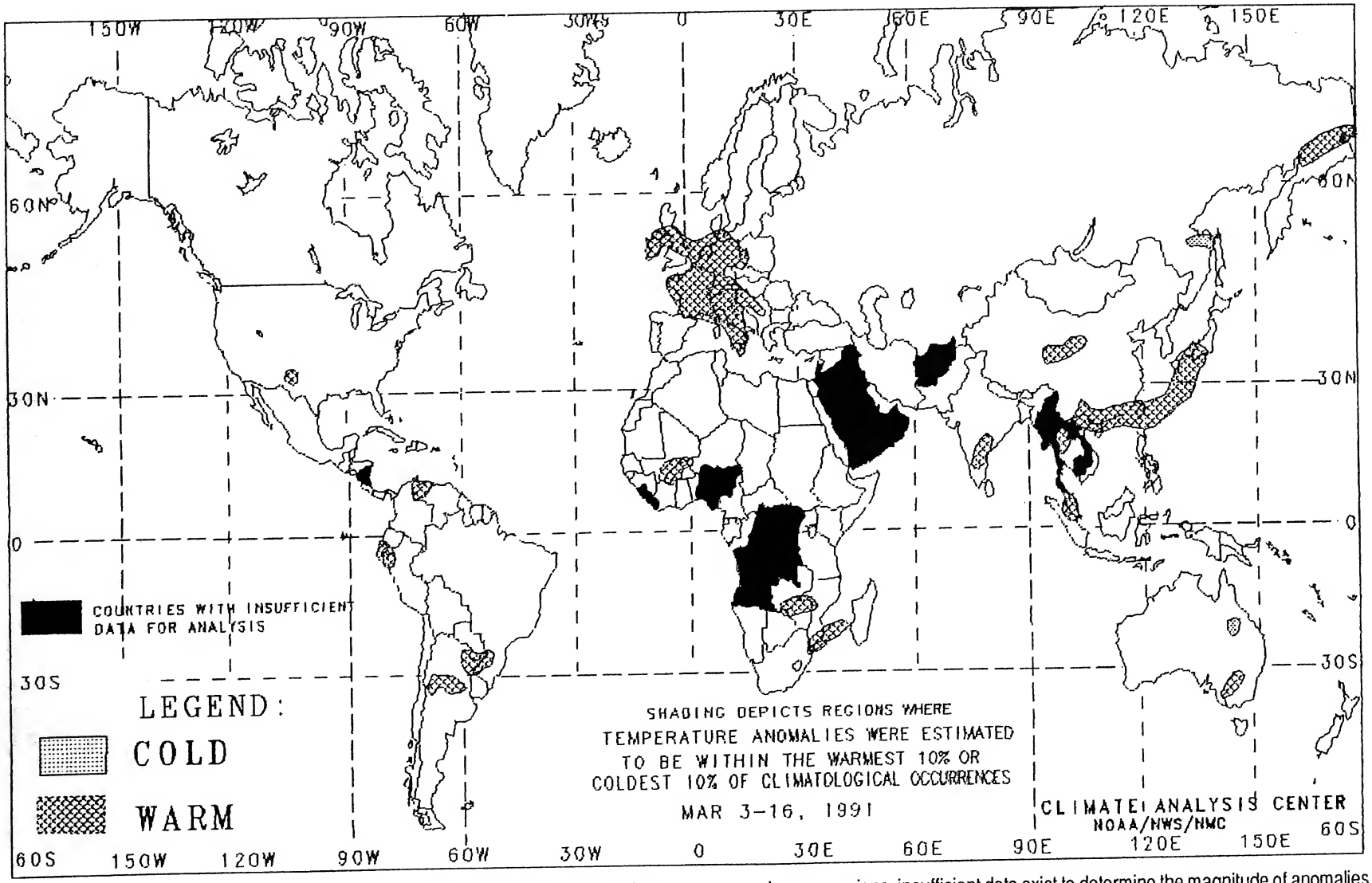
WEEKLY DEPARTURE FROM NORMAL HDD

March 10 – 16, 1991



GLOBAL TEMPERATURE ANOMALIES

2 WEEKS



The anomalies on this chart are based on approximately 2500 observing stations for which at least 13 days of temperature observations were received from synoptic reports. Many stations do not operate on a twenty–four hour basis so many night time observations are not taken. As a result of these missing observations the estimated minimum temperature may have a warm bias. This in turn may have resulted in an overestimation of the extent of some warm anomalies.

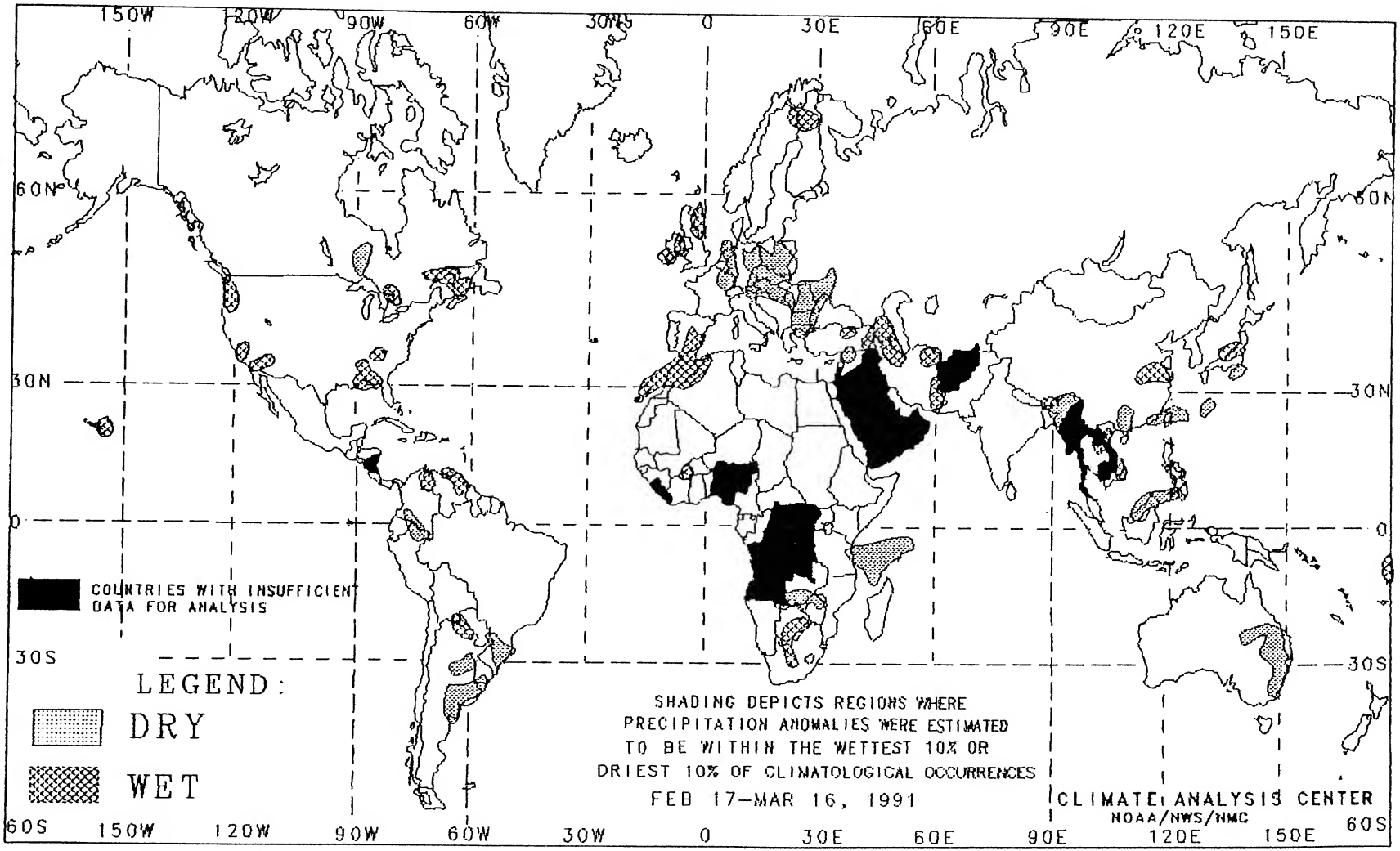
Temperature anomalies are not depicted unless the magnitude of temperature departures from normal exceeds 1.5°C.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

This chart shows general areas of two week temperature anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

GLOBAL PRECIPITATION ANOMALIES

4 WEEKS



The anomalies on this chart are based on approximately 2500 observing stations for which at least 27 days of precipitation observations (including zero amounts) were received or estimated from synoptic reports. As a result of both missing observations and the use of estimates from synoptic reports (which are conservative), a dry bias in the total precipitation amount may exist for some stations used in this analysis. This in turn may have resulted in an overestimation of the extent of some dry anomalies.

In climatologically arid regions where normal precipitation for the four week period is less than 20 mm, dry anomalies are not depicted. Additionally, wet anomalies for such arid regions are not depicted unless the total four week precipitation exceeds 50 mm.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of four week precipitation anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

UNITED STATES SEASONAL CLIMATE HIGHLIGHTS

WINTER (December–February) 1990–91

The Winter of 1990–91 was marked by sharply contrasting monthly and regional temperature and precipitation patterns. The season began rather inconspicuously, with relatively mild and tranquil weather covering much of the nation during the first half of December. Around mid–month, a bitterly cold Arctic air mass sent temperatures plummeting throughout the western half of the country. Vegetable and fruit [particularly the navel orange] crops in California were severely damaged as well as the winter wheat in Washington. Farther east, however, unseasonably mild weather persisted along the Atlantic Seaboard. Between the two contrasting air masses, strong storm systems developed, dropping heavy precipitation on much of the Tennessee and Ohio Valleys, Great Lakes, and New England. National conditions returned to more seasonable levels during January, although copious rains inundated the Gulf Coast states while the Far West remained exceptionally dry. During February, however, spring–like conditions prevailed nationwide. Nearly all of the lower 48 states recorded well above normal monthly temperatures, resulting in the third warmest February since 1895. In addition, precipitation was rather deficient throughout the U.S. (except for the Tennessee and lower Mississippi Valleys), particularly in the Far West and central Plains, ranking as the second driest February during the past 97 years. As the season ended, a strong Pacific storm finally brought substantial precipitation to California, but did little to ease the 5–year drought in California [front cover] as mandatory water restrictions were increased. In the Southeast, however, the wet winter eradicated any remnants of last year's dryness across the eastern Gulf and southern Atlantic Coasts with the exception of peninsular Florida.

December 1990 commenced with a powerful storm system producing heavy precipitation from the southern Plains northeastward into New England. Up to 8 inches of rain inundated southeastern Louisiana while southern Wisconsin was buried under 2 feet of snow. Mild and dry conditions then prevailed over the nation until the mid–month cold snap in the West. A reading of –59°F was recorded at Middle Sink, UT while temperatures dropped into the upper teens and lower twenties for 5 consecutive days in central and southern California's major agricultural valleys. Despite slightly above normal temperatures during the first half of December, the cold wave was of such intensity that the West and Northwest regions both observed the coldest December on record. Meanwhile, the Gulf and Atlantic Coast states basked in unseasonable warmth as intense thunderstorms erupted in the boundary between these two air masses causing heavy rain and several tornadoes. Severe flooding resulted from torrential rains and rapid snow melt in the Tennessee and Ohio Valleys.

In January, flooding in the Ohio Valley gradually abated as the heavy rains shifted southward along the Gulf Coast where frequent winter storms dumped heavy precipitation from Texas eastward to northern Florida and then northeastward to the Delmarva Peninsula. Many stations along the Gulf and southern Atlantic Coasts shattered January precipitation records such as Apalachicola, FL with 23.48 inches. Unfortunately, the drought worsened across much of the West as the upper–air flow pattern directed Pacific storm systems away from the California, Oregon, and Washington coasts. Cold air finally pushed into the East during the fourth week of January as lows briefly fell below freezing in northern Florida. Temperatures returned to above normal levels along the Pacific Coast but a persistent dome of high pressure kept cold air trapped in the Great Basin and central Rockies.

During the first ten days of February, extremely mild and relatively dry weather prevailed over much of the country as over 170 daily maximum temperature records were set. Around mid–month, however, a short–lived cold snap in the eastern half of the country dropped readings to freezing as far south as central Florida and the Gulf Coast, but temperatures quickly rebounded to much above normal levels during the last third of the month. Around mid–February, moderate to heavy snowfall brought badly–needed moisture to the Dakotas while another round of copious rains (up to 13 inches) pounded the lower Mississippi and Tennessee Valleys, producing severe flooding. Farther east, drier conditions returned to the southern Atlantic Coast states after a wet January. Savannah, GA had their driest February on record [0.26 inches] following their wettest January [8.98 inches]. Dry weather also dominated the remainder of the contiguous U.S. as the drought worsened in the West, and parts of the central Plains reported no measurable monthly precipitation. At the month's end, however, the first in a series of intense early March storms pelted much of California with heavy precipitation, finally providing the state some short–term relief.

According to the River Forecast Centers, the greatest seasonal precipitation (more than 20 inches) was reported along the western and central Gulf Coast from southeastern Texas across to the Florida Panhandle and southwestern Georgia, in northern sections of Mississippi and Alabama into central Tennessee, along parts of the Pacific Northwest Coast and in the northern Cascades, and portions of southern Alaska and eastern Hawaii. In addition to these areas, above normal winter precipitation fell on much of the southern Great Plains, lower and middle Mississippi, Tennessee, and Ohio Valleys, eastern Great Lakes, along the eastern Gulf and southern Atlantic Coasts, and on parts of the upper Midwest, New England, and southern Intermountain West [Table 1, Figures 2 and 3]. On a state–wide basis, Ohio, Tennessee, Louisiana, Kentucky, and Indiana observed one of the ten wettest winters on record. Regionally, only the Central had significantly high seasonal precipitation (6th wettest).

In sharp contrast, exceptional dryness occurred during the Winter across much of the Far West, Great Basin, northern and central Rockies and Plains, central Florida, and western Hawaii [Table 2, Figures 2 and 3]. The winter dryness was particularly acute along the southern Pacific Coast not only because of long–term drought, but since most locations normally receive over half the annual precipitation during December–February. In California, the fifth driest autumn on record was followed by the fifth driest winter, greatly increasing the probability that 1990–91 will be the fifth consecutive subnormal rainy season (Oct–Apr) even if heavy March and April rains occur. Six other states had one of the ten driest winters on record [ID, KS, MT, NV, OR, OK]. Substantial winter dryness was observed in the West [3rd], Northwest [6th], and West–North Central [6th] regions, resulting in the fifteenth driest winter nationally.

Above normal seasonal temperatures prevailed over the majority of the nation in spite of the record cold December in the Far West. A milder than usual winter was observed in the eastern half of the country, northern and central Plains, most of the Southwest, and in Hawaii and much of Alaska [Table 3, Figures 4 and 5]. The greatest departures (more than +4°F) were found along the Atlantic Seaboard where Arctic outbreaks were infrequent and short–lived during much of the Winter. As a result, 13 eastern states experienced one of the ten mildest winters on record, easing demands on heating requirements. Enough cold air, however, invaded the remainder of the lower 48 states during the early Winter, keeping this year's national winter temperature to only the 31st warmest Dec–Feb since 1895.

Colder than normal conditions, however, persisted through much of the Winter in the northern and central Intermountain West and central Rockies, especially during mid–December through early February, as temperatures averaged up to 6°F below normal in eastern Utah and western Colorado [Table 4, Figures 4 and 5]. Slightly below normal seasonal temperatures also occurred in much of the Pacific Northwest and southern Plains, and in portions of the middle Mississippi Valley, desert Southwest, and western and southern Alaska.

TEMPERATURE AND PRECIPITATION RANKINGS FOR DEC 1990–FEB 1991, BASED ON THE PERIOD 1895–96 TO 1990–91. 1 = DRIEST/COLDEST AND 96 = WETTEST/HOTTEST.

REGION	*PRECIPITATION*	*TEMPERATURE*
NORTHEAST	67	**88**
EAST NORTH CENTRAL	29	63
CENTRAL	**91**	75
SOUTHEAST	69	84
WEST NORTH CENTRAL	*6*	62
SOUTH	72	59
SOUTHWEST	50	35
NORTHWEST	*6*	35
WEST	*3*	37
NATIONAL	15	66

National Climatic Data Center

Top 10 rankings : **BOLD** Bottom 10 rankings : *Italics*

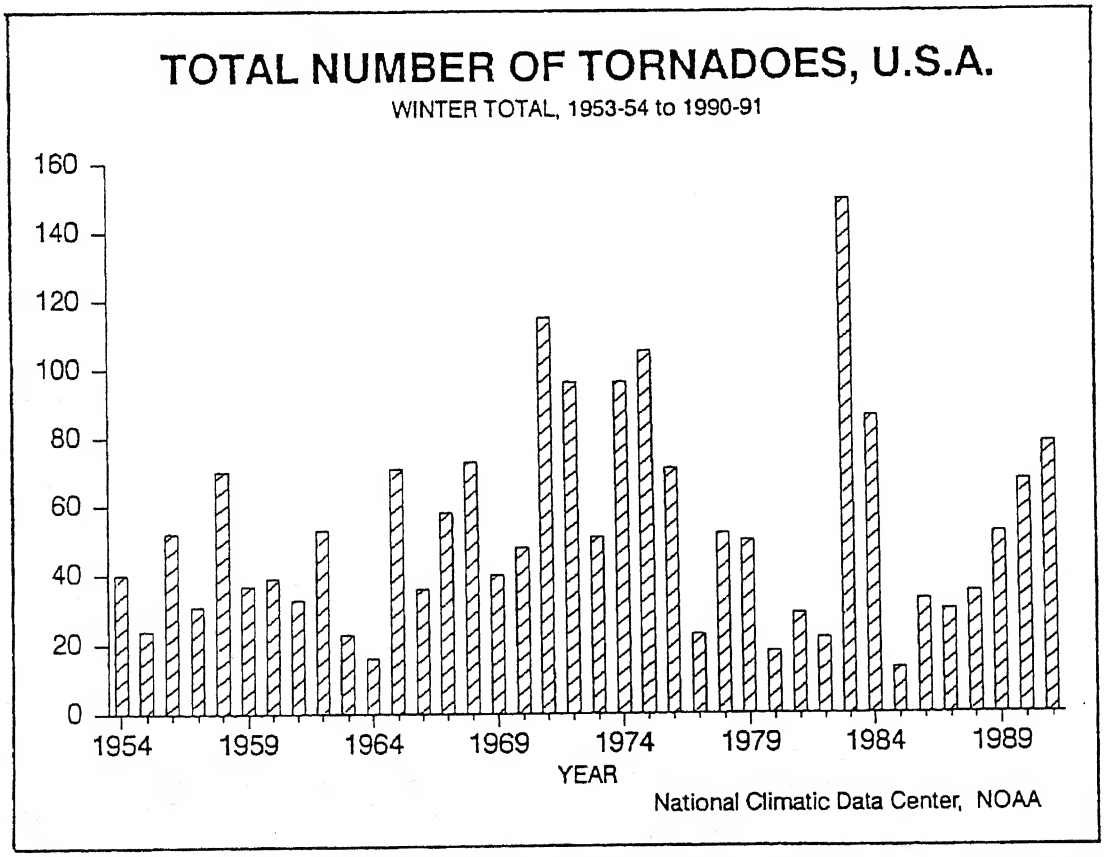


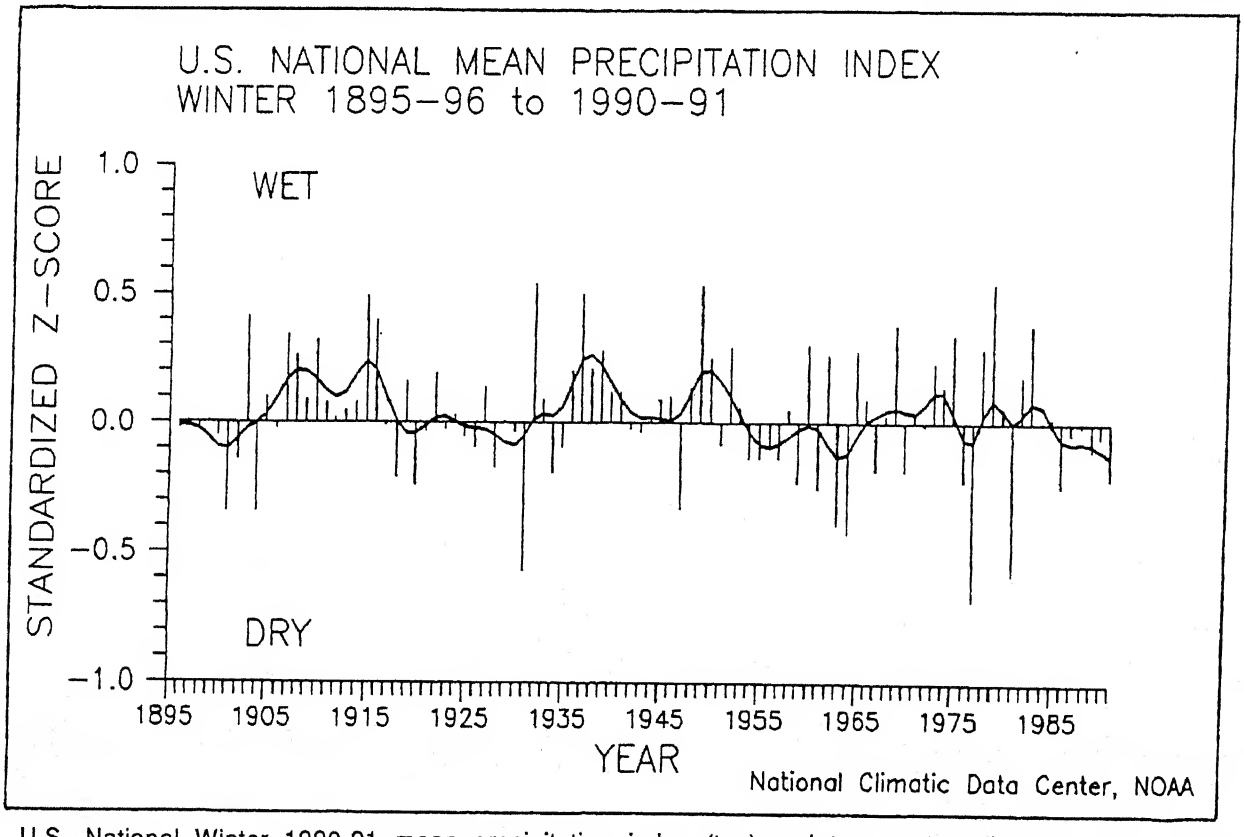
Figure 1. *Total number of tornadoes in the contiguous U.S., Winter (December-February), 1953-54 to 1990-91. Tornado activity this Winter was at near-record high numbers during December and January, but a rather tranquil (and dry) February brought the seasonal total closer to (but still above) normal [obs=78, avg=52].*

PRECIPITATION RANKINGS FOR DEC–FEB 1990–91, BASED ON THE PERIOD 1895 TO 1991. 1 = DRIEST 96 = WETTEST.

STATE	RANK	STATE	RANK	STATE	RANK	STATE	RANK
AL	79	*IA*	*37*	NE	21	RI	59
AZ	57	*KS*	*8*	*NV*	*4*	SC	60
AR	58	**KY**	**90**	NH	38	SD	50
CA	*5*	**LA**	**91**	NJ	63	**TN**	**91**
CO	21	ME	39	NM	72	TX	68
CT	48	MD	67	NY	74	UT	17
DE	56	MA	40	NC	48	VT	57
FL	79	MI	19	ND	40	VA	47
GA	78	MN	44	**OH**	**93**	WA	18
ID	*4*	**MS**	**92**	OK	18	WV	83
IL	75	MO	69	*OR*	*3*	WI	32
IN	**89**	*MT*	*9*	PA	79	*WY*	*3*

National Climatic Data Center

Top 10 rankings : **BOLD** Bottom 10 rankings : *Italics*



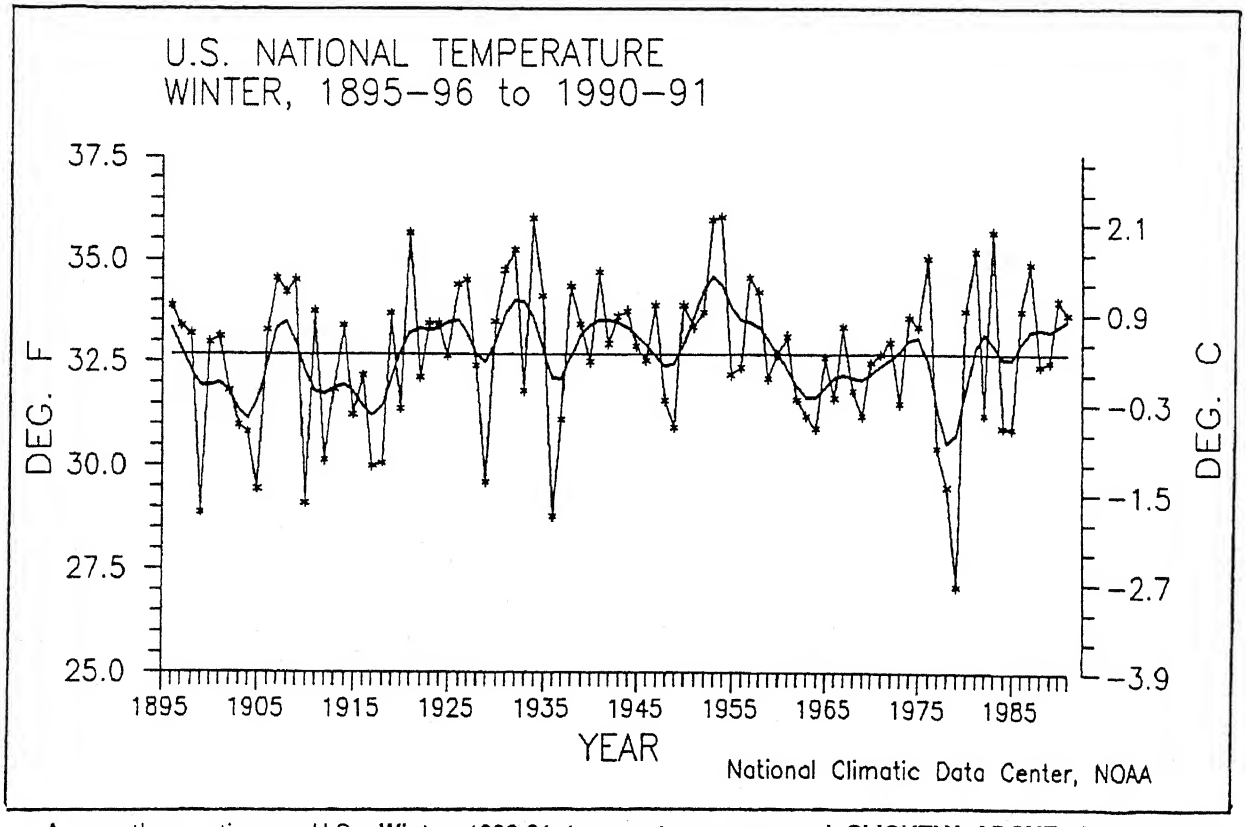
U.S. National Winter 1990-91 mean precipitation index (top) and temperature (bottom). The monthly precipitation for each climate division in the country (total of 344) was first standardized over the 1951-1980 period, then weighed by area and averaged to determine a national standardized precipitation value. Negative (positive) values are dry (wet). Based upon the index, the **Winter 1990-91 precipitation was BELOW the long-term mean** (the 15th driest Winter during the past 96 years). As the Winter progressed, monthly rankings gradually became lower (drier) nationally [December (46th wettest), January (38th driest), and February (2nd driest)], with extremely dry seasonal conditions in the West [3rd], Northwest [6th], and West-North Central [6th] regions. In fact, most locations in the western half of the country measured subnormal seasonal precipitation. The Central region, however, recorded the 6th wettest Winter since 1895, and above normal seasonal precipitation covered most of the Deep South, Tennessee and Ohio Valleys, and parts of New England thanks to ample December and January precipitation.

TEMPERATURE RANKINGS FOR DEC–FEB 1990–91, BASED ON THE PERIOD 1895 TO 1991. 1 = COLDEST AND 96 = WARMEST.

STATE	*RANK*	*STATE*	*RANK*	*STATE*	*RANK*	*STATE*	*RANK*
AL	77	IA	43	NE	57	**RI**	**91**
AZ	61	KS	59	NV	32	SC	82
AR	40	KY	86	**NH**	**92**	SD	59
CA	44	LA	57	NJ	93	TN	78
CO	18	ME	76	NM	40	TX	46
CT	**92**	**MD**	**92**	**NY**	**87**	UT	22
DE	**87**	**MA**	**88**	**NC**	**87**	**VT**	**91**
FL	**87**	MI	77	ND	70	**VA**	**92**
GA	79	MN	63	OH	85	WA	37
ID	31	MS	79	OK	67	**WV**	**87**
IL	53	MO	44	OR	36	WI	61
IN	78	MT	60	**PA**	**89**	WY	43

National Climatic Data Center

Top 10 rankings : **BOLD** Bottom 10 rankings : *Italics*

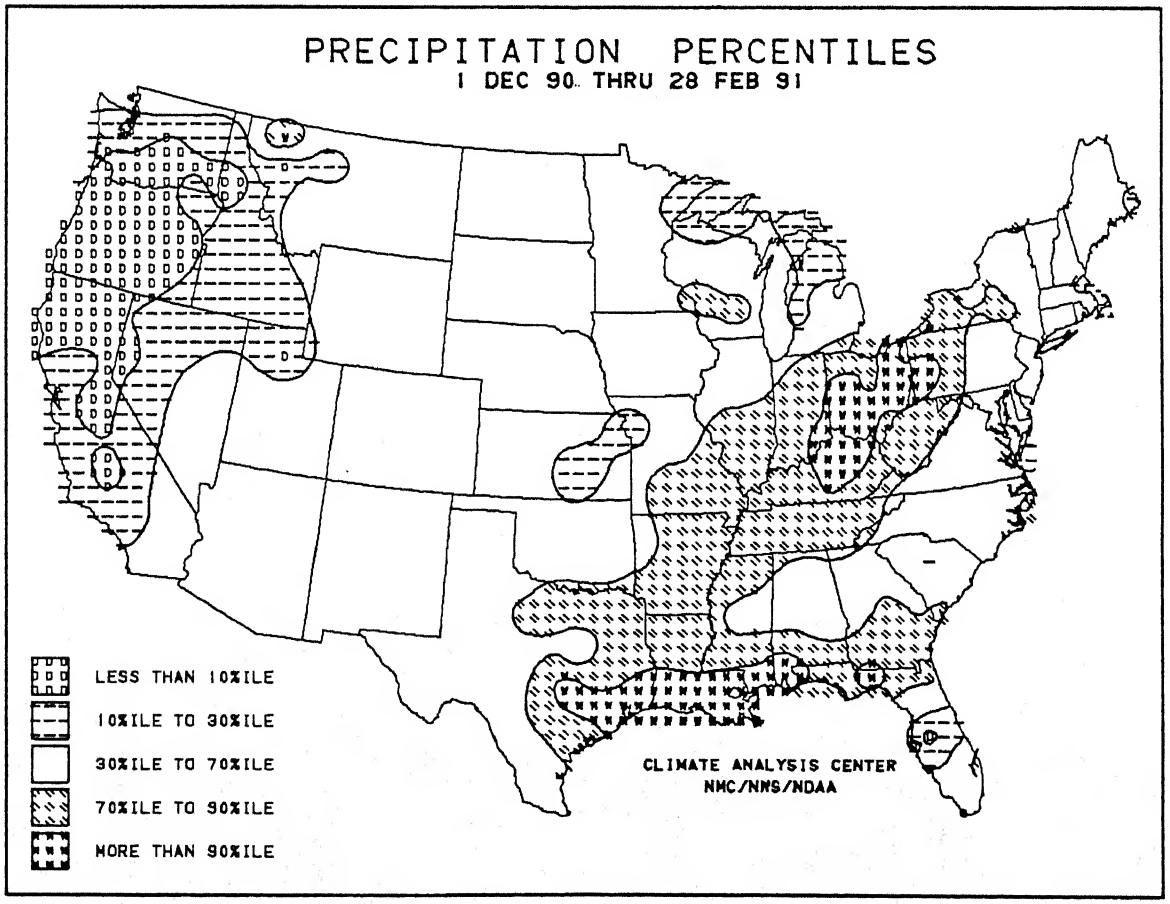


Across the contiguous U.S., **Winter 1990-91 temperatures averaged SLIGHTLY ABOVE the long-term mean**, ranking as the 31st warmest Winter since 1895 (96 years). Similar to the monthly winter precipitation, national monthly temperature rankings gradually changed, in this case from low (cold) to high (warm) [e.g. December (18th coldest), January (32nd coldest), and February (3rd warmest)]. Most of the frigid weather was concentrated in the western third of the U.S. during the early Winter (coldest December on record in the West and Northwest) while subnormal January temperatures occurred in the nation's midsection. During February, however, near-record warmth covered much of the lower 48 states, tilting the national Winter temperatures towards a higher (warmer) seasonal ranking.

ɪLE 1. SELECTED STATIONS WITH 150% OR MORE OF THE NORMAL PRECIPITATION) 18.00 INCHES OR MORE PRECIPITATION; OR, STATIONS WITH 23.00 INCHES OR RE PRECIPITATION AND NO NORMALS DURING WINTER 1990-91.

ION	TOTAL (INCHES)	PCT. OF NORMAL	STATION	TOTAL (INCHES)	PCT. OF NORMAL
ORLEANS/MOISANT, LA	34.35	223.1	VALDOSTA, GA	23.94	***
'SVILLE, AL	29.76	193.4	LAFAYETTE, LA	23.47	164.2
ORLEANS/LAKE FRONT, LA	29.67	***	PORT ARTHUR, TX	23.22	176.0
LO, MS	28.51	***	BATON ROUGE, LA	22.31	153.4
;LE SHOALS, AL	28.46	192.7	VALPARAISO/EGLIN AFB, FL	22.23	176.4
)MB, MS	26.89	***	ALEXANDRIA/ENGLAND AFB, LA	22.18	158.8
ACHICOLA, FL	25.80	242.2	BOWLING GREEN, KY	21.98	167.8
AK, AK	25.74	157.5	PENSACOLA, FL	21.93	162.9
OSTA/MOODY AFB, GA	25.61	***	JACKSON, TN	21.57	156.1
MBUS AFB, MS	25.09	***	LAKE CHARLES, LA	20.94	161.1
LE, AL	24.63	165.6	JACKSON, KY	20.59	184.7
ORLEANS NAS, LA	24.53	***	COLLEGE STATION, TX	19.32	229.4
AHASSEE, FL	24.27	171.2	GALVESTON, TX	18.86	211.9
CI/KEESLER AFB, MS	23.96	175.5			

(Note: Stations without precipitation normals are indicated by asterisks.)



igure 2. Winter 1990-91 temperature percentiles. December-February, typically the three wettest months of e year across much of the Far West, were instead exceptionally dry (<30%ile), particularly in northern alifornia, Oregon, and southern Washington (<10%ile). Significant seasonal dryness also covered the upper reat Lakes, central Great Plains, and central Florida. In sharp contrast, substantial winter wetness (>70%ile) ccurred along the Gulf Coast, in the lower Mississippi, Tennessee, and eastern Ohio Valleys, with extremely eavy precipitation (>90%ile) along the central Gulf Coast and in most of Ohio and northern Kentucky.

TABLE 2. SELECTED STATIONS WITH 60% OR LESS NORMAL PRECIPITATION AND NORMAL PRECIPITATION 7.00 INCHES OR MORE DURING WINTER 1990-91.

STATION	TOTAL (INCHES)	PCT. OF NORMAL	NORMAL (INCHES)	STATION	TOTAL (INCHES)	PCT. OF NORMAL	NORMAL (INCHES)
SANTA BARBARA, CA	2.80	29.1	9.62	MEDFORD, OR	4.37	48.7	8.97
TAMPA, FL	3.02	41.4	7.29	SACRAMENTO, CA	4.90	50.3	9.75
SALINAS, CA	3.28	44.7	7.34	MEACHAM, OR	5.25	41.5	12.66
STOCKTON, CA	3.40	45.8	7.43	REDDING, CA	5.42	24.9	21.73
PASO ROBLES, CA	3.40	46.3	7.35	MOUNT SHASTA, CA	5.56	29.3	18.97
UKIAH, CA	3.45	15.3	22.51	LIHUE, KAUAI, HI	5.61	36.6	15.32
SAN BERNARDINO, CA	3.84	41.5	9.26	SAN FRANCISCO, CA	5.82	51.2	11.37
LOS ANGELES, CA	3.93	53.3	7.11	BLUE CANYON, CA	7.10	19.9	35.74
LONG BEACH, CA	3.97	52.2	7.60	EUREKA, CA	7.31	39.8	18.36
ORLANDO, FL	4.17	58.2	7.17	PORTLAND, OR	8.63	52.4	16.45
DAYTONA BEACH, FL	4.24	55.2	7.68	SALEM, OR	8.96	48.0	18.65
SEXTON SUMMIT, OR	4.33	24.4	17.77	EUGENE, OR	11.78	53.7	21.94
RED BLUFF, CA	4.34	38.3	11.33				

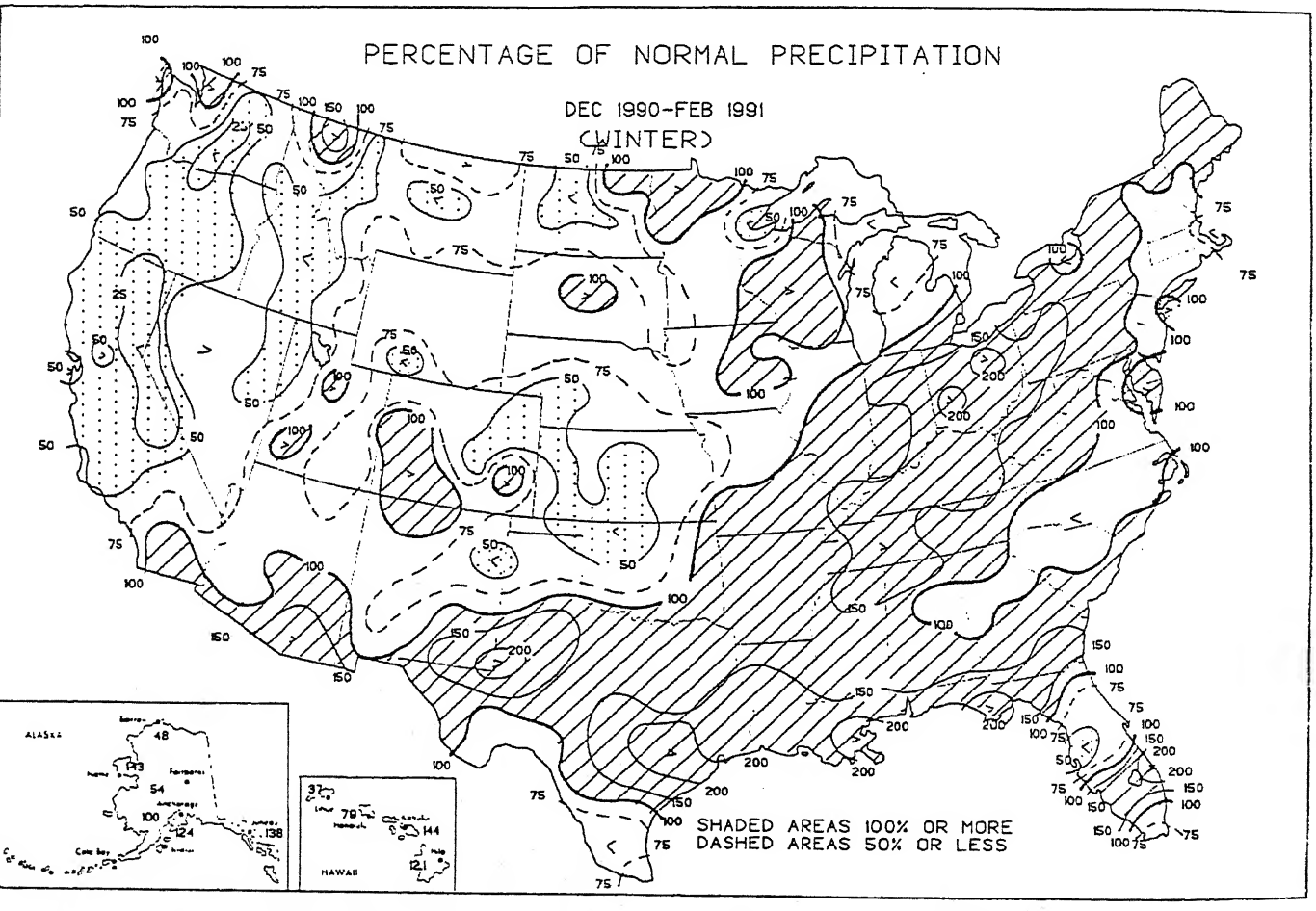


Figure 3. Winter 1990-91 percent of normal precipitation. Subnormal seasonal precipitation generally occurred in the western and northern sections of the contiguous U.S. while the east-central and southern states recorded surplus winter precipitation. Severe flooding accompanied the heavy precipitation during December in the Tennessee Valley, along the Gulf Coast during January, and once again in the Tennessee Valley during February. In contrast, the dryness in the Far West was especially critical in California as this Dec.-Feb. (normally the wettest time of the year) became the 5th consecutive winter with well below normal precipitation. The western sections of Hawaii reported below normal rainfall while eastern areas observed surplus winter totals. Alaska was generally close to normal except for dryness in the interior and northern portions.

TABLE 3. WINTER 1990-91 AVERAGE TEMPERATURES 4.8°F OR MORE ABOVE NORMAL.

STATION	DEPARTURE (°F)	AVERAGE (°F)	STATION	DEPARTURE (°F)	AVERAGE (°F)
NORTHWAY, AK	+7.1	-9.1	NORFOLK, VA	+5.1	46.7
NEW YORK/LA GUARDIA, NY	+5.7	39.6	NEW YORK/KENNEDY, NY	+5.1	38.3
BURLINGTON, VT	+5.7	25.1	ALBANY, NY	+5.1	28.9
CAPE HATTERAS, NC	+5.6	52.2	RICHMOND/BYRD, VA	+5.0	43.5
PHILADELPHIA, PA	+5.6	39.1	PATUXENT RIVER NAS, MD	+5.0	42.8
HAMPTON/LANGLEY AFB, VA	+5.5	46.4	WILMINGTON, DE	+5.0	38.3
ERIE, PA	+5.5	32.5	BRADFORD, PA	+5.0	27.0
TAMPA, FL	+5.4	66.0	PITTSBURGH, PA	+4.9	34.3
WASHINGTON/DULLES AIRPORT, VA	+5.4	38.2	HARTFORD, CT	+4.9	32.5
PORTLAND, ME	+5.4	28.9	ORLANDO, FL	+4.8	65.7
VALDEZ, AK	+5.4	25.1	CHARLESTON, SC	+4.8	54.0
FORT MYERS, FL	+5.3	69.3	GREENSBORO, NC	+4.8	44.0
BECKLEY, WV	+5.3	37.5	ROANOKE, VA	+4.8	41.9
ZANESVILLE, OH	+5.3	35.0	CHARLESTON, WV	+4.8	40.1
DEVIL'S LAKE, ND	+5.3	12.8	BALTIMORE-WASHINGTON, MD	+4.8	39.4
MORGANTOWN, WV	+5.2	37.1			

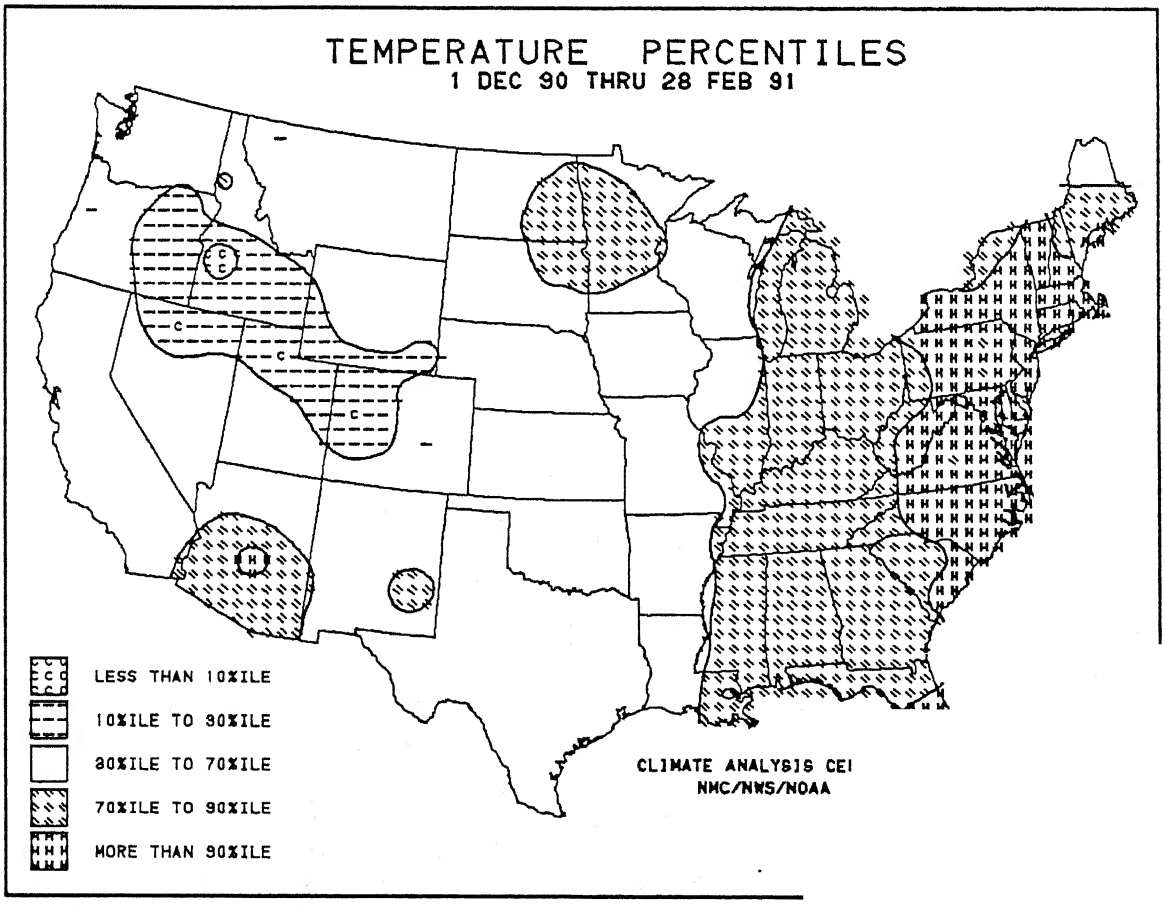


Figure 4. *Winter 1990-91 temperature percentiles. Substantial winter warmt country east of the Mississippi River as Arctic air outbreaks were relative the Winter. Farther west, however, a bitterly cold December (coldest Dec Northwest regions) and somewhat cold January in the Rockies overcan nationwide, producing a significantly cold (<30%ile) winter in the northern*

TABLE 4. WINTER 1990-91 AVERAGE TEMPERATURES 2.0°F OR MORE BELOW NORMAL.

STATION	DEPARTURE (°F)	AVERAGE (°F)	STATION	DEPARTURE (°F)	AVERAGE (°F)
GRAND JUNCTION, CO	-6.0	23.1	BURNS, OR	-2.9	26.4
BOISE, ID	-5.0	27.6	OGDEN/HILL AFB, UT	-2.9	26.6
LOVELOCK, NV	-4.4	27.9	IDAHO FALLS, ID	-2.5	19.2
FARMINGTON, NM	-4.3	27.4	ELKO, NV	-2.5	24.7
WINNEMUCCA, NV	-4.1	27.8	PENDLETON, OR	-2.3	33.6
SALT LAKE CITY, UT	-4.0	27.0	KALISPELL, MT	-2.2	21.4
CEDAR CITY, UT	-3.7	27.8	TUCUMCARI, NM	-2.2	36.9
POCATELLO, ID	-3.5	23.2	WENATCHEE, WA	-2.0	29.3
ST. PAUL ISLAND, AK	-3.3	22.6	PUEBLO, CO	-2.0	30.4
BAKER, OR	-3.3	24.7	KINGSVILLE NAS, TX	-2.0	58.5

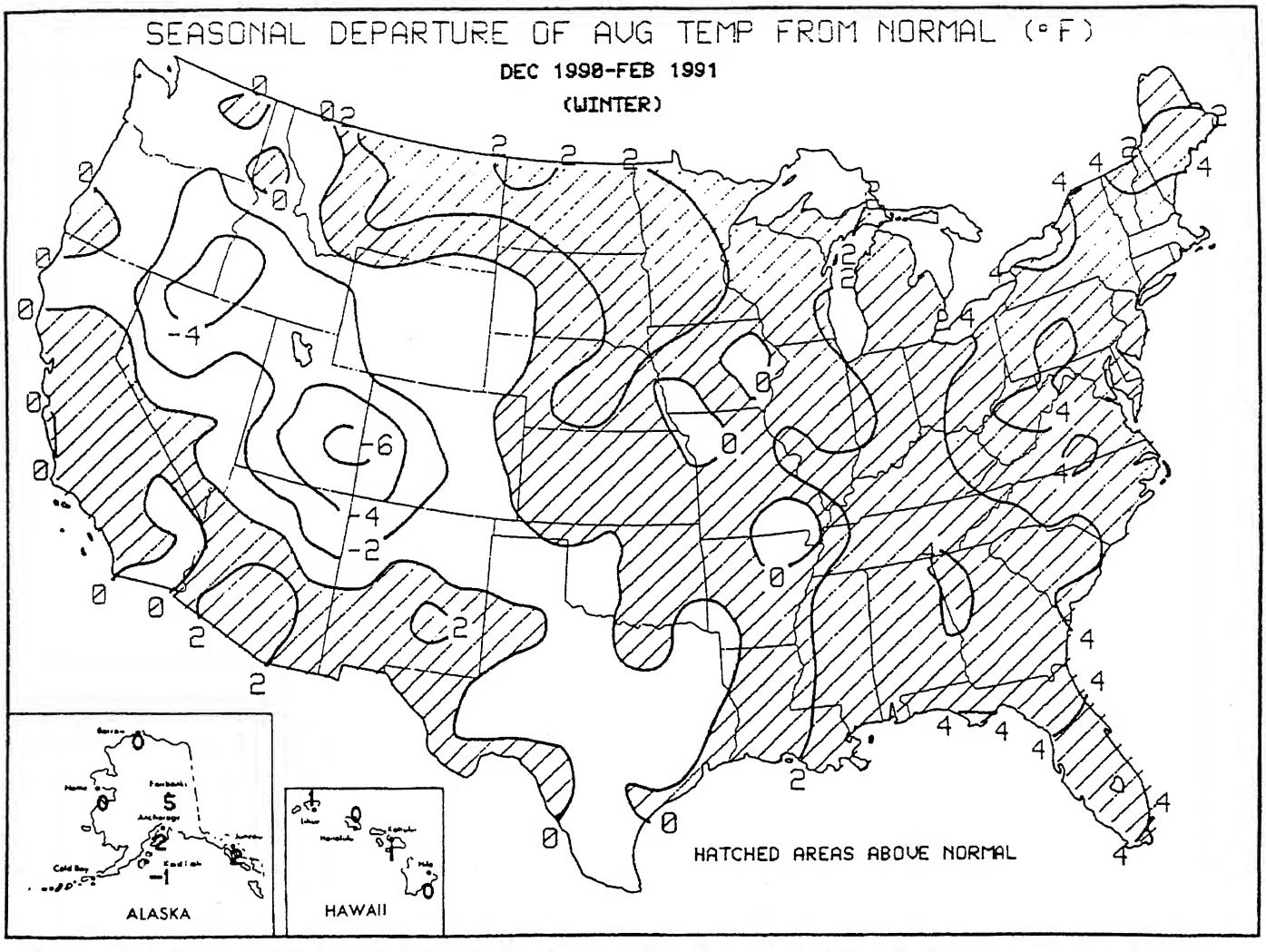


Figure 5. Winter 1990-91 average temperature departure from normal (°F). Above normal seasonal temperatures dominated the eastern half of the nation, particularly along the Eastern Seaboard (departures more than +4°F), while colder than usual winter conditions were found in much of the West, especially the Great Basin and central Rockies (departures less than -2°F), thanks to a bitterly cold December. December 1990-February 1991 temperatures averaged near to slightly above normal across much of Alaska and Hawaii.

STATISTICS FOR SELECTED RIVER BASINS: PRECIPITATION RANKING FOR DEC–FEB 1990–91 , WHERE RANK OF 1 = DRIEST, 96 = WETTEST, BASED ON THE PERIOD 1895 TO 1991; AREAL PERCENT OF THE BASIN EXPERIENCING SEVERE OR EXTREME LONG–TERM (PALMER) DROUGHT, AND AREAL PERCENT OF THE BASIN EXPERIENCING SEVERE OR EXTREME LONG–TERM (PALMER) WET CONDITIONS, AS OF FEBRUARY, 1991. RIVER BASIN REGIONS AS DEFINED BY THE U.S. WATER RESOURCES COUNCIL.

RIVER BASIN	PRECIPITATION RANK	% AREA DRY	% AREA WET
Missouri Basin	*5*	40.0	.0
Pacific Northwest Basin	*6*	47.6	.7
California Basin	*4*	83.0	.0
Great Basin	*8*	73.2	.0
Upper Colorado Basin	*10*	68.3	.0
Lower Colorado Basin	61	10.4	.0
Rio Grande Basin	58	.0	22.2
Arkansas–White–Red Basin	39	3.7	1.8
Texas Gulf Coast Basin	80	.0	.0
Souris–Red–Rainy Basin	50	57.0	.0
Upper Mississippi Basin	56	.0	6.2
Lower Mississippi Basin	**90**	.0	5.5
Great Lakes Basin	54	.0	45.1
Ohio River Basin	**90**	.0	64.3
Tennessee River Basin	**91**	.0	41.7
New England Basin	46	.0	7.7
Mid–Atlantic Basin	64	.0	10.1
South Atlantic–Gulf Basin	71	9.4	3.0

Top 10 Rankings: **Bold** Bottom 10 Rankings: *Italics*